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WORLD CLASS – through people, technology and dedication



Operational satellite based oil spill and ship detection services

A case study from Northern Europe

by

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Kongsberg Satellite Services

- KSAT Company and Infrastructure
- Multinational Oil and Ship detection service concept
 - North Sea and Baltic experiences
- Global Near Real Time Data Service





KSAT – the Company

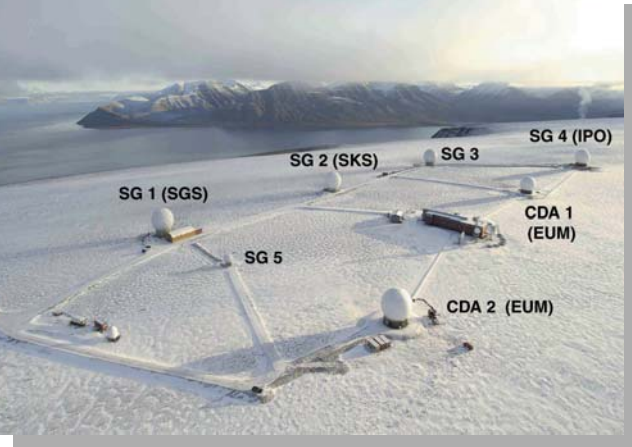
World Leading Commercial Satellite Centre for:

- **Satellite based Surveillance Services**
 - Marine Surveillance Services
 - Focus on SAR missions

- **Polar Ground Station Support (TT&C services)**
 - Launch Support
 - Satellite In-Orbit Support
 - Data Acquisition and processing
 - Number of contacts supported daily:
 - Svalbard: 80 contacts
 - Tromsø: 60 contacts

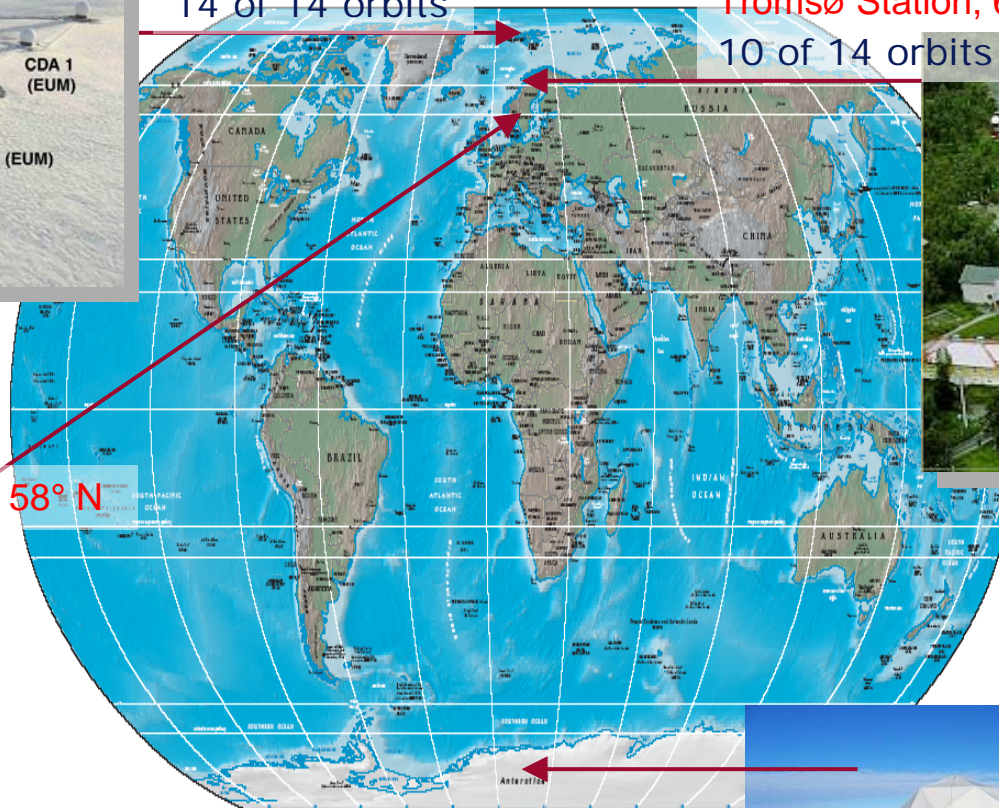


KSAT Satellite Centers - Pole to Pole



SvalSat, 78° N
14 of 14 orbits

Tromsø Station, 69° N,
10 of 14 orbits



Grimstad, 58° N



TrollSat/Antarctica, 72° S
12 of 14 orbits





KSAT - Customers

Current missions:

- NASA: Aqua, AM-1 Terra, Icesat, Aura (2004), Landsat-7, EO-1, QSCAT, Gravity, Probe B, Acrimsat, Cobe, Coriolis, Dart
- ESA: Envisat, ERS-2
- ISRO: IRS-1C, IRS-1D, IRS P4, IRS P5 (Cartosat 1), IRS P6 (Resourcesat 1), IRS-TES
- CSA/RSI: Radarsat-1
- JAXA: INDEX
- DigitalGlobe: Quickbird 2
- NSPO: Formosat
- CNES: Spot-1
- Other: NOAA 15, NOAA16, NOAA17, Coriolis, SAC-C, Seawifs, Kompsat, Champ, Grace-1, Grace-2, COSPAS-SARSAT
- Launch: Ariane IV og V
- LEOP: Long list of missions for NASA/JAXA/ESA



KSAT – Comming missions:

- IPO/NOAA: NPP, NPOESS
- JAXA/ESA: Solar-B
- JAXA: ASTRO-F, GOSAT
- Eumetsat: Metop-1/2/3
- KARI: Kompsat-2
- ESA: GOCE, AEOLUS
- DLR: SAR-LUPE
- CSA/RSI: Radarsat-2
- OrbImage: OrbView-5, (Nextview 2)
- DigitalGlobe: Worldview





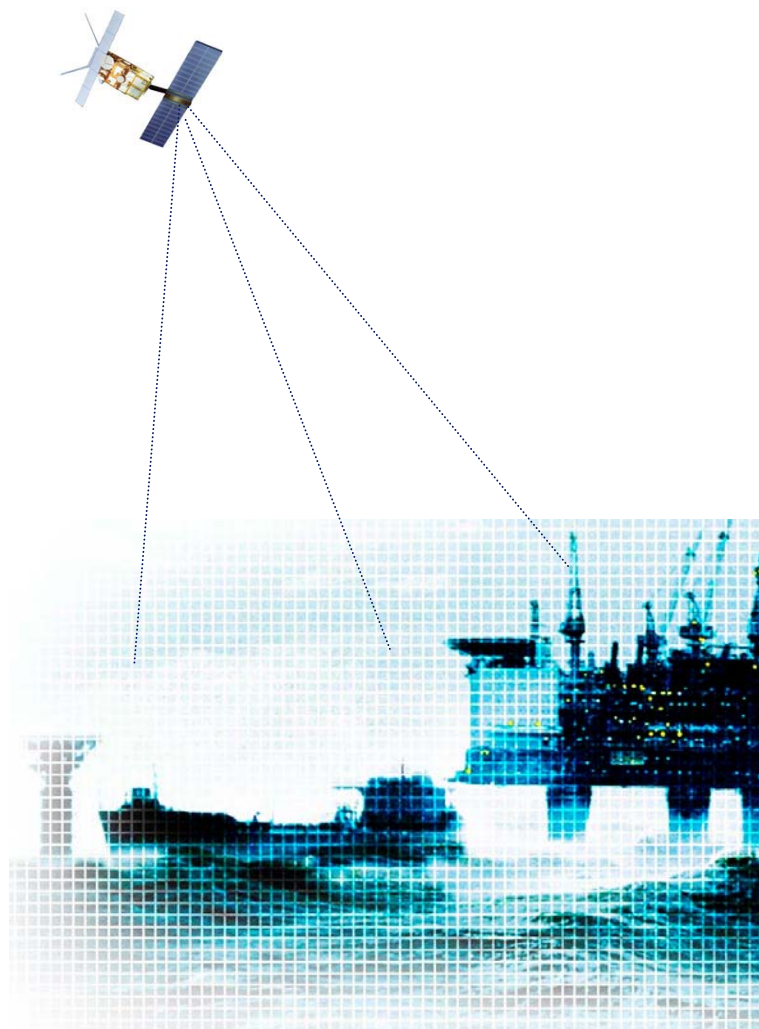
KSAT Ship- and Oil spill detection services

"If information is older than 1-2 hours it is useless"

(Swedish Coastguard)

KSAT Earth Observation; Key elements

- Focus on SAR missions - supported by optical data
 - Radarsat-1 (1996),
 - Radarsat-2 (2006)
 - ERS (1991),
 - Envisat (2001)
 - New missions for service continuity and new products and markets
- Round the clock near real-time operations
- Information services
 - Detection of oil spills
 - Ship positions
 - Wind
 - Ice monitoring
 - Flooding, snow cover, etc....



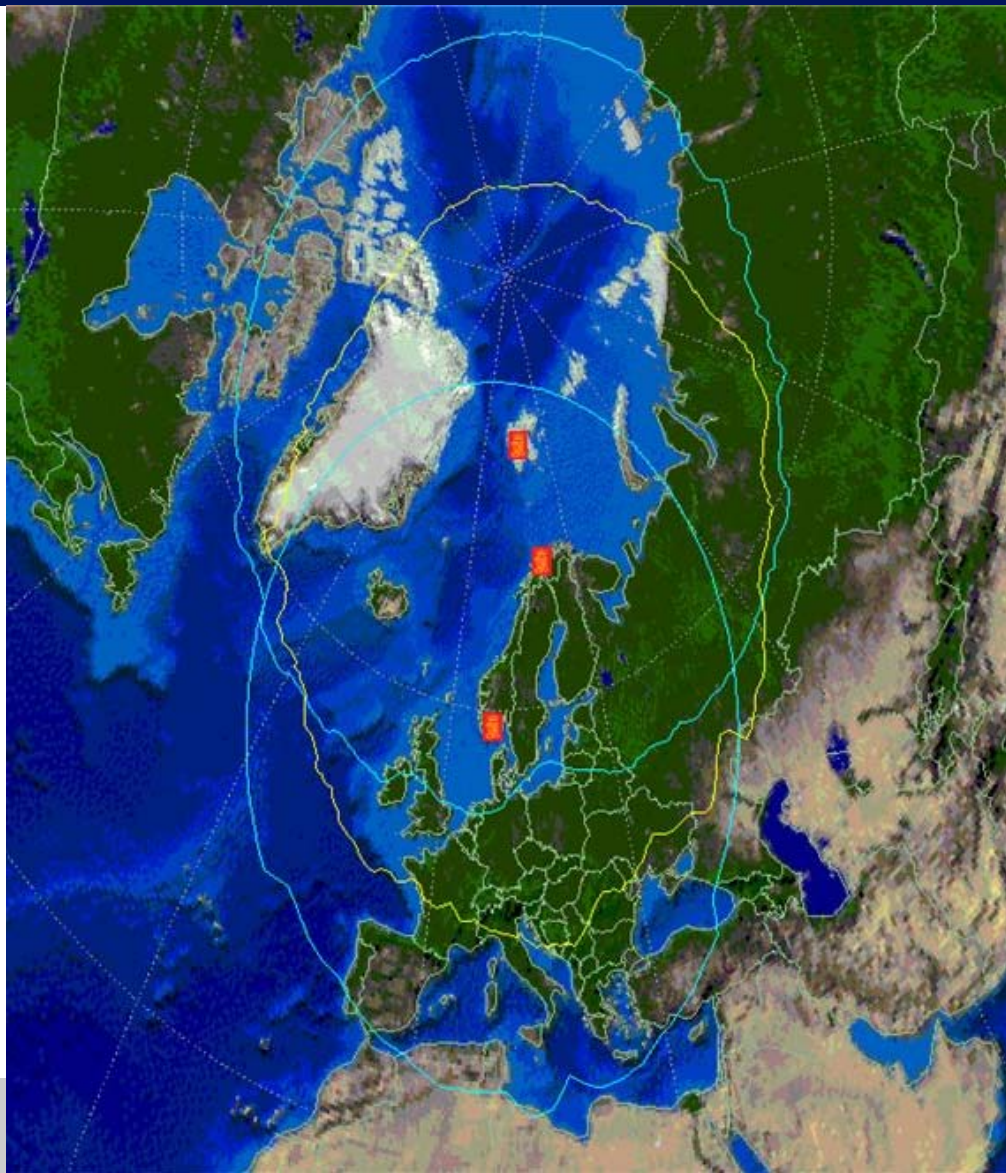


KSAT Oil and Ship Detection Service

- Traditional marine surveillance programs are based on a combination of coastal radars, airborne and vessel monitoring
 - Limited coverage and costly
- Satellite based Synthetic Aperture Radar (SAR) has become an important sensor for oil pollution, vessel traffic and ice monitoring
- Norway started in 1991 with R&D activities and the oil spill service has been operational since 1998
- Ship detection service was established in 2004
- Customers are pollution control authorities and oil companies in Northern Europe
- The service is operational, reliable and meets the user requirements
- Well integrated and complements customers existing surveillance system

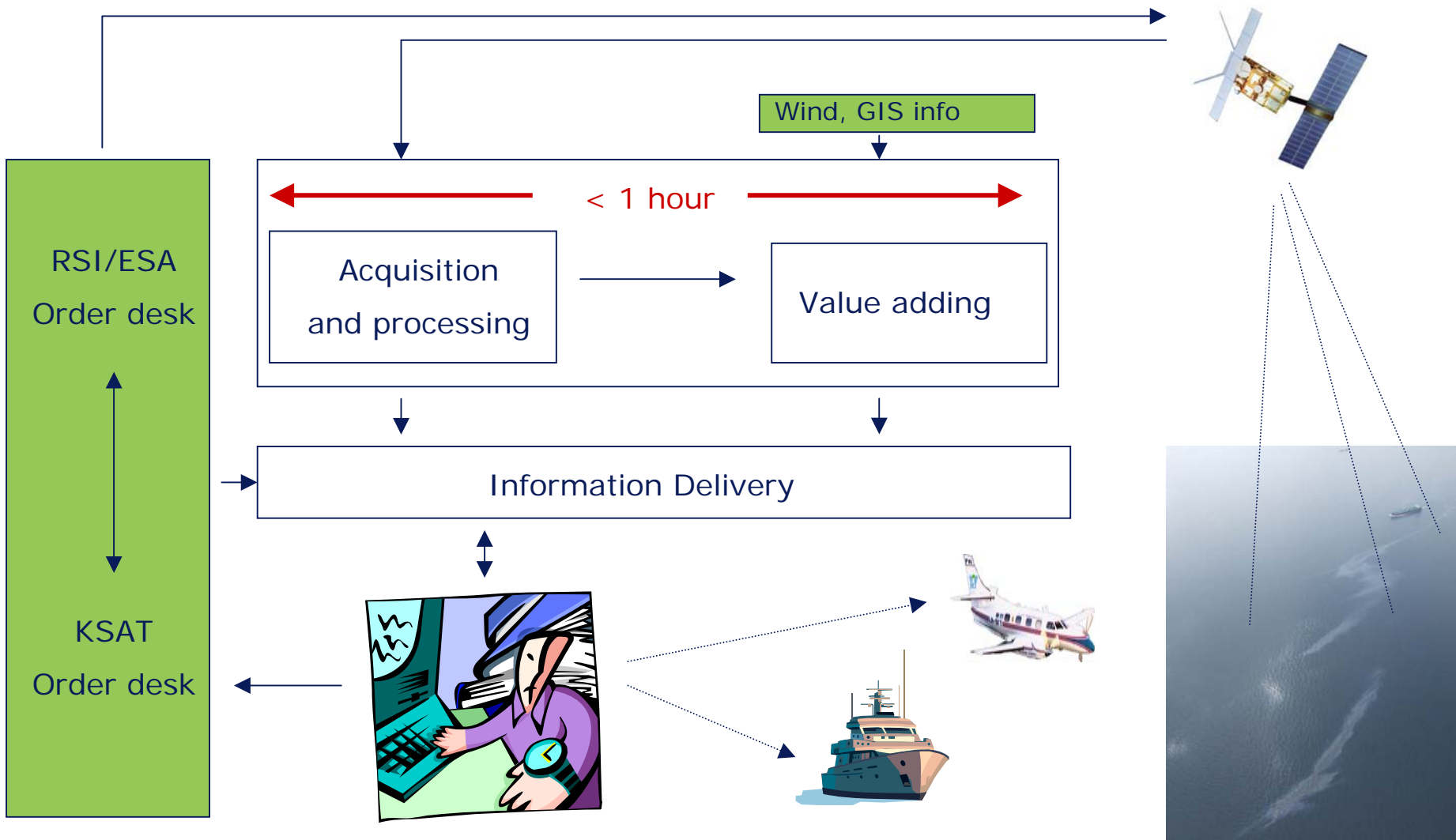
KSAT – Direct Downlink

- Direct downlink over:
 - Svalbard
 - Tromsø
 - Grimstad
 - Antarctica
- Information delivery in less than one hour



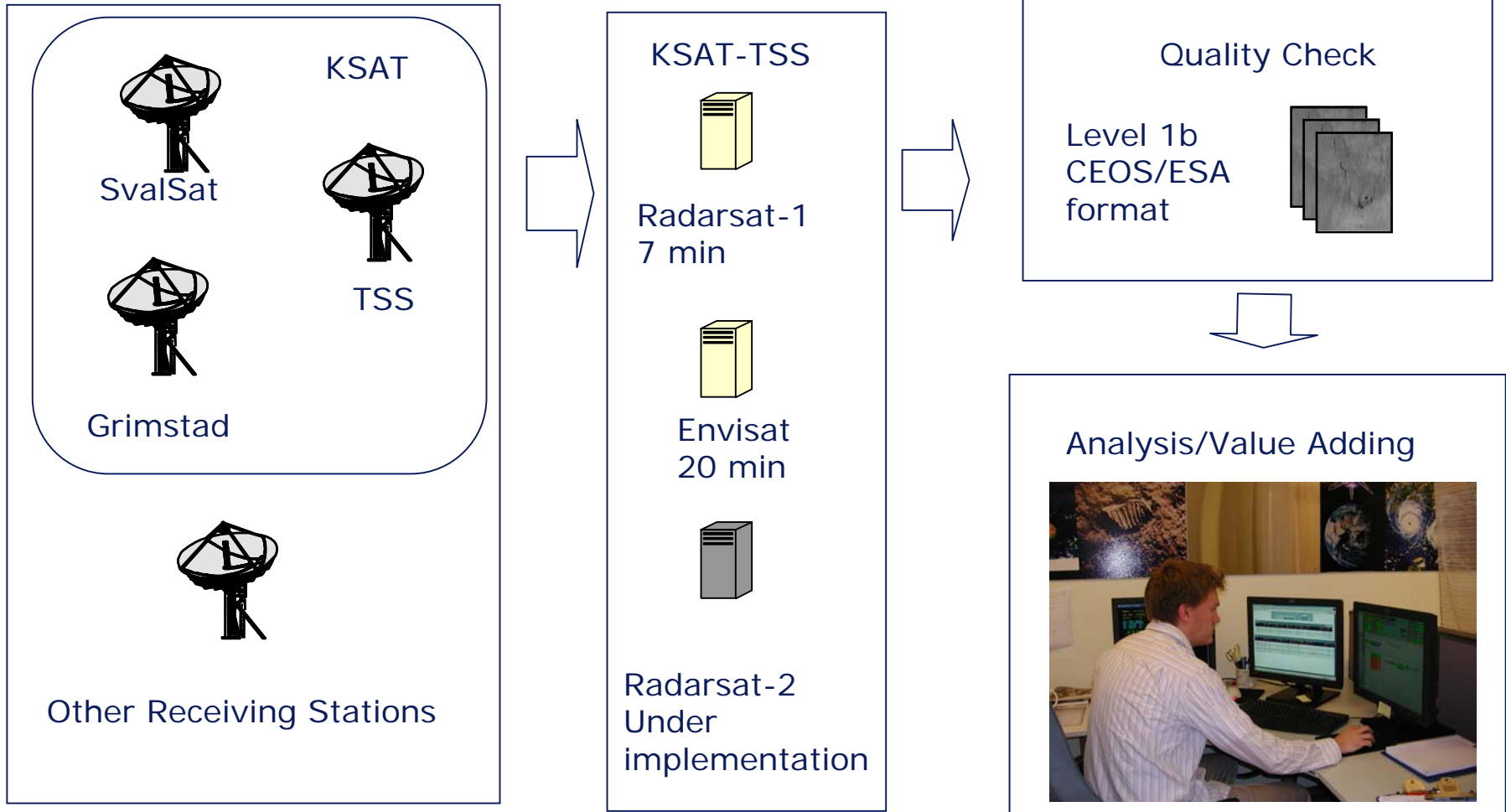


Near Real Time Service Chain





Data Processing and Value adding



Information delivery

Customer Web contains:

- Scheduled satellite passes
- Oil spill and ship reports
- Oil spill classifications
- Time and location
- Source of oil spill
- Ship detection including AIS
- Location of vessels (accuracy < 1km)
- Vessel size (# pixels)
- Vessel speed and heading
- Images
- Comments
- Feedback function

Visard – End user tool

Kongsberg Satellite Services North Sea Oil Service

File Edit View Favorites Tools Help

Current Last 10 Last 50 Next 10 All Planned Previous

Date	Time	Satellite	Customer	Report	Files
2005-03-16	17:28:53	Radarsat	nss	No slicks	09
2005-03-16	21:49:56	Envisat	nss	No slicks	09
2005-03-22	22:01:28	Envisat	nss	No slicks	09
2005-03-23	05:59:57	Radarsat	nss	No slicks	09
2005-03-23	17:24:44	Radarsat	nss	No slicks	09
2005-03-26	06:12:21	Radarsat	nss	No slicks	09
2005-03-26	10:12:08	Envisat	nss	No slicks	09
2005-03-29	10:18:12	Envisat	nss	No slicks	09
2005-03-29	21:41:23	Envisat	nss	No slicks	09
2005-03-30	05:55:39	Radarsat	nss	No slicks	09
2005-03-30	17:20:57	Radarsat	nss	No slicks	09
2005-04-02	06:08:10	Radarsat	nss	No slicks	09
2005-04-04	10:29:29	Envisat	nss	None	None
2005-04-04	21:52:53	Envisat	nss	None	None
2005-04-06	17:16:31	Radarsat	nss	No slicks	09

Plain map Grid map Overlay map

1:11123877 (2/2)

Oslo, Belfast, Dublin, Greater London, Amsterdam, Bruxelles, Luxembourg-Ville, Paris, St. Helier

www.ksat.no

Kongsberg Satellite Services Baltic Oil Service

Feedback page.

KSAT report: Oilspill ID 1

Coordinates: High
 Country: SVKESK
 Latitude/Longitude: 5010744"N / 016140754"E
 Area: 4.46 km²
 Height/width: 0.2261 / 17.8844 km
 Orientation: NE-SW
 Wind direction: SW
 Wind speed: 3 m/s
 Possible sources:
 Source position: 5010640"N / 01613735"E

Comments:
 Minimum contrast click in connection with ship. Diffuse edges, wind speed is area 3 m/s

Please select:
 Not Checked
 Confirmed oil
 Fossil Alga
 Other phenomena
 Nothing observed

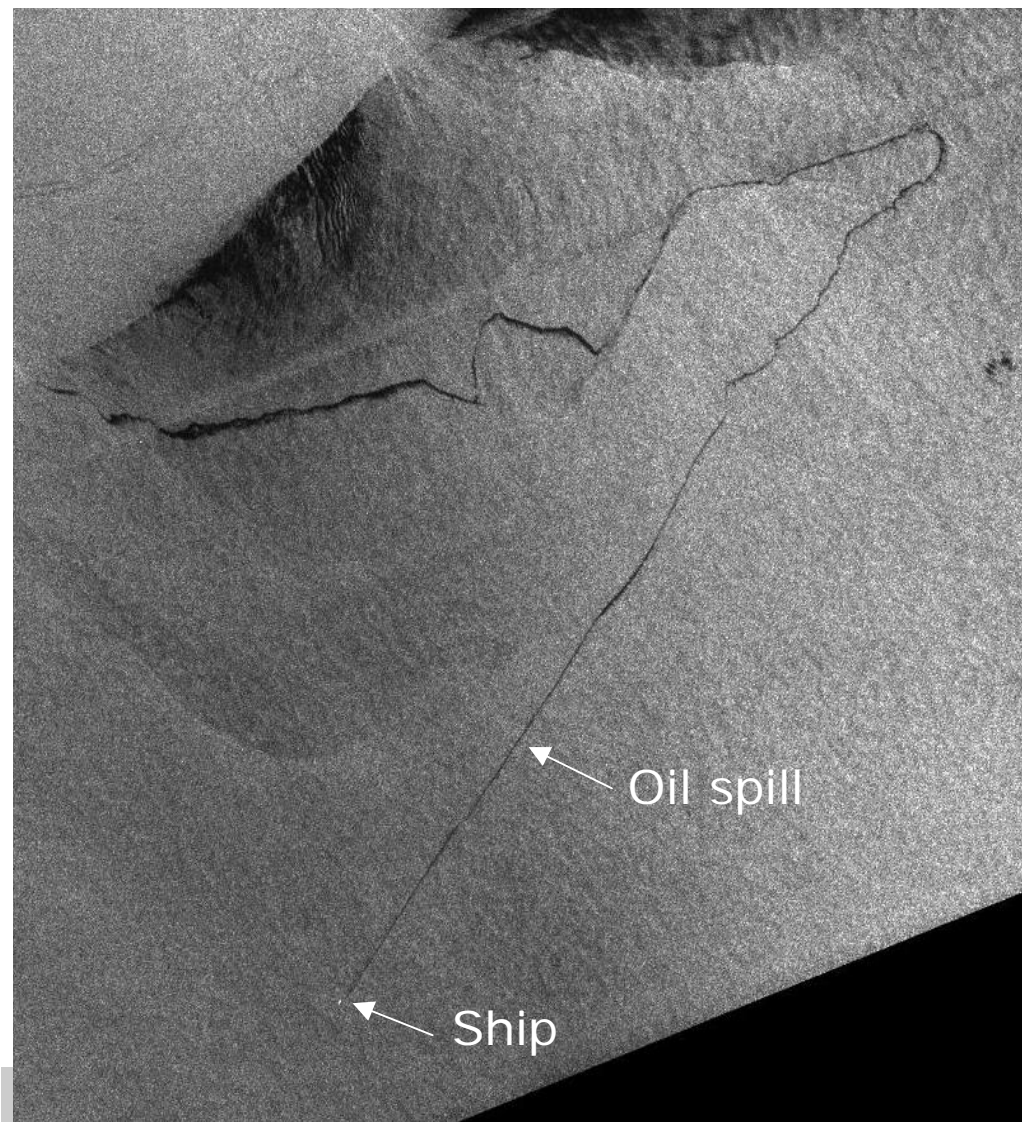
Comments:
 Min 110 liters Max 1200 liters / Finn

Checked time: 07:25 utc
 Checked by: Ole Cig Arpaard 503

Submit report to KOSAT

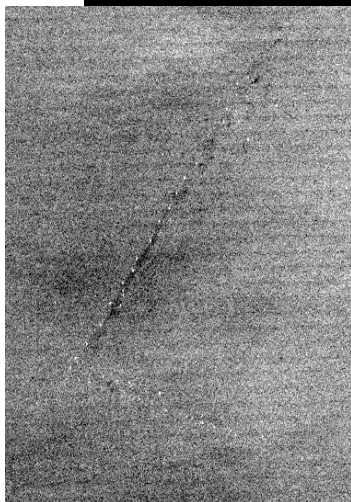
Oilspill images:

Oil Spill, South of Norway



- Oil at sea dampens the waves

Ship Detection

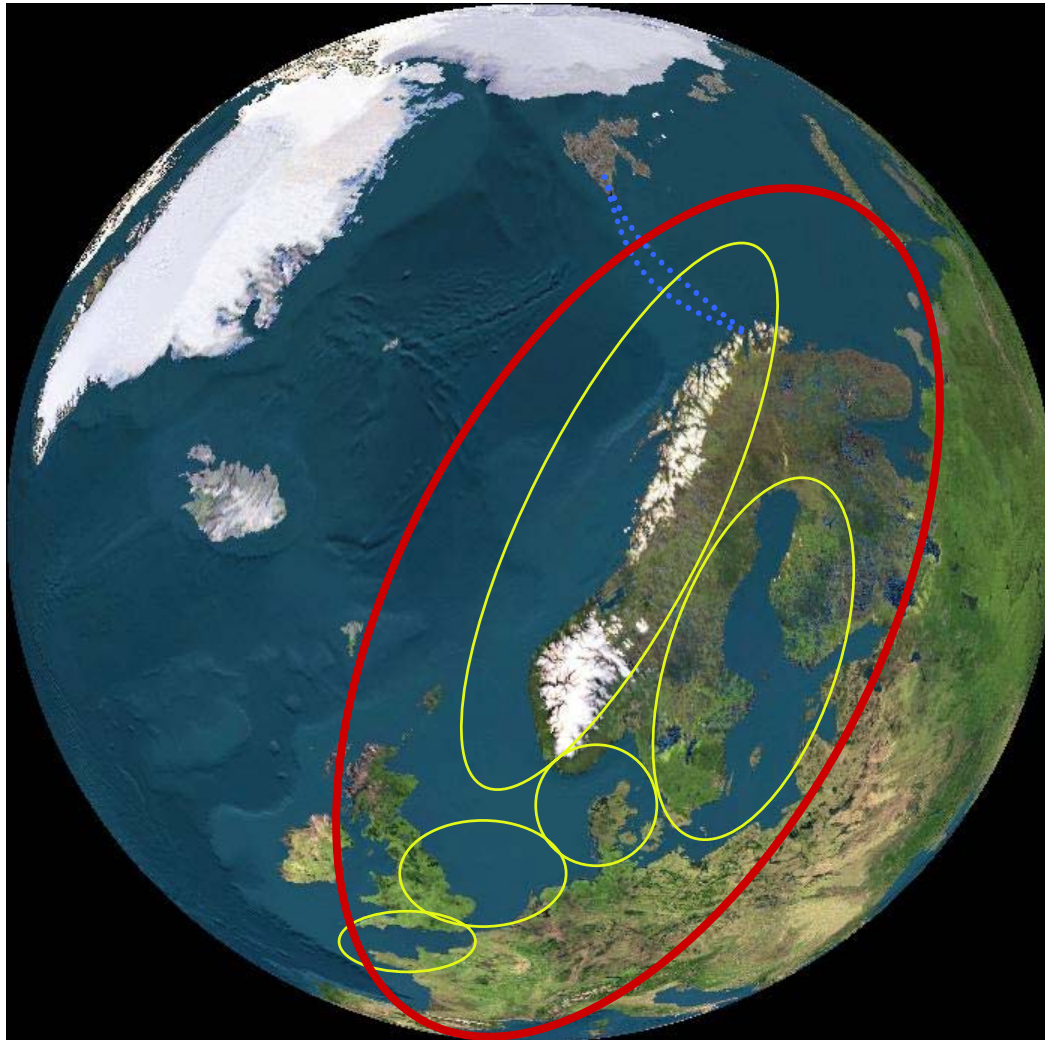


- Detection of ships in SAR Images
- Combined with aircraft for monitoring of fisheries etc.



canadienne, 1996. Received, processed and distributed by ISS.

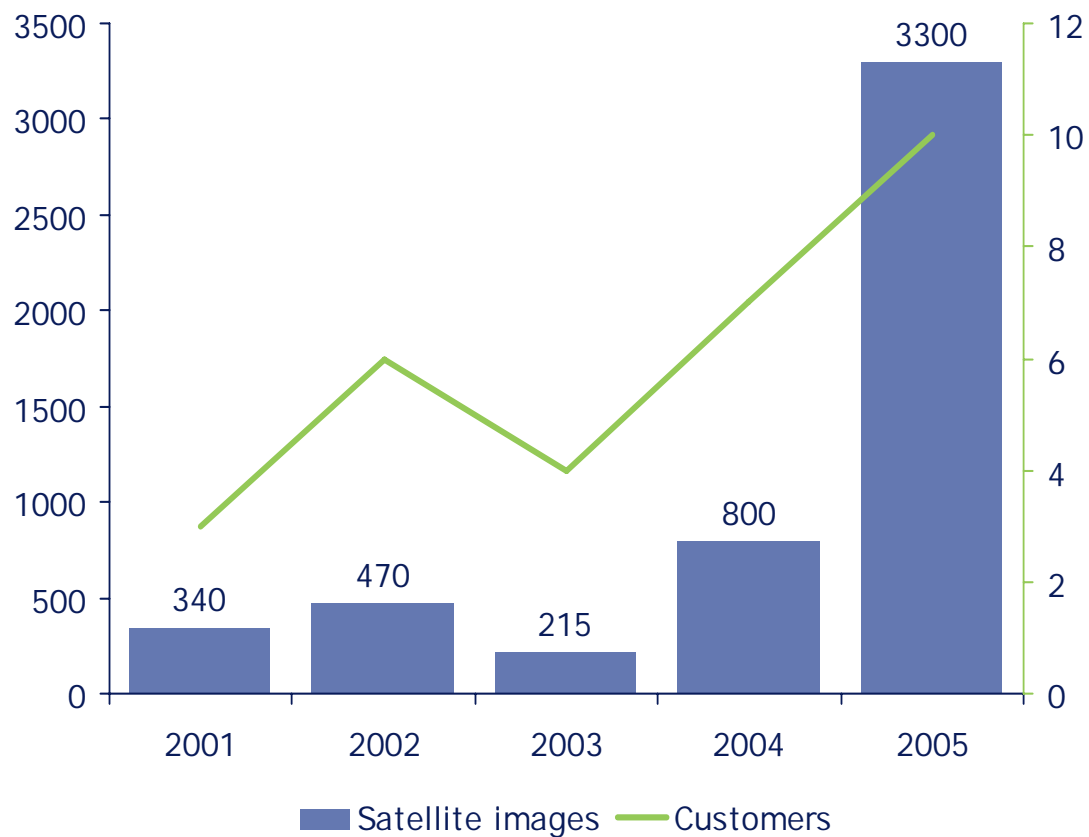
From single user to multinational service concept



- KSAT had four separate services:
 - Barents Sea
 - Baltic
 - North Sea
 - English Channel
- Merged into ONE Northern-European Oil spill service in March 2004
- Service is available for all paying customers
- Service development has been supported by the ESA Market Development Project on Marine Surveillance



Northern European Oil Service growth



Customers are:

- Pollution control authorities
- Oil companies

Countries included:

- United Kingdom
- Holland
- Germany
- Belgium
- Sweden
- Finland
- Norway
- Poland

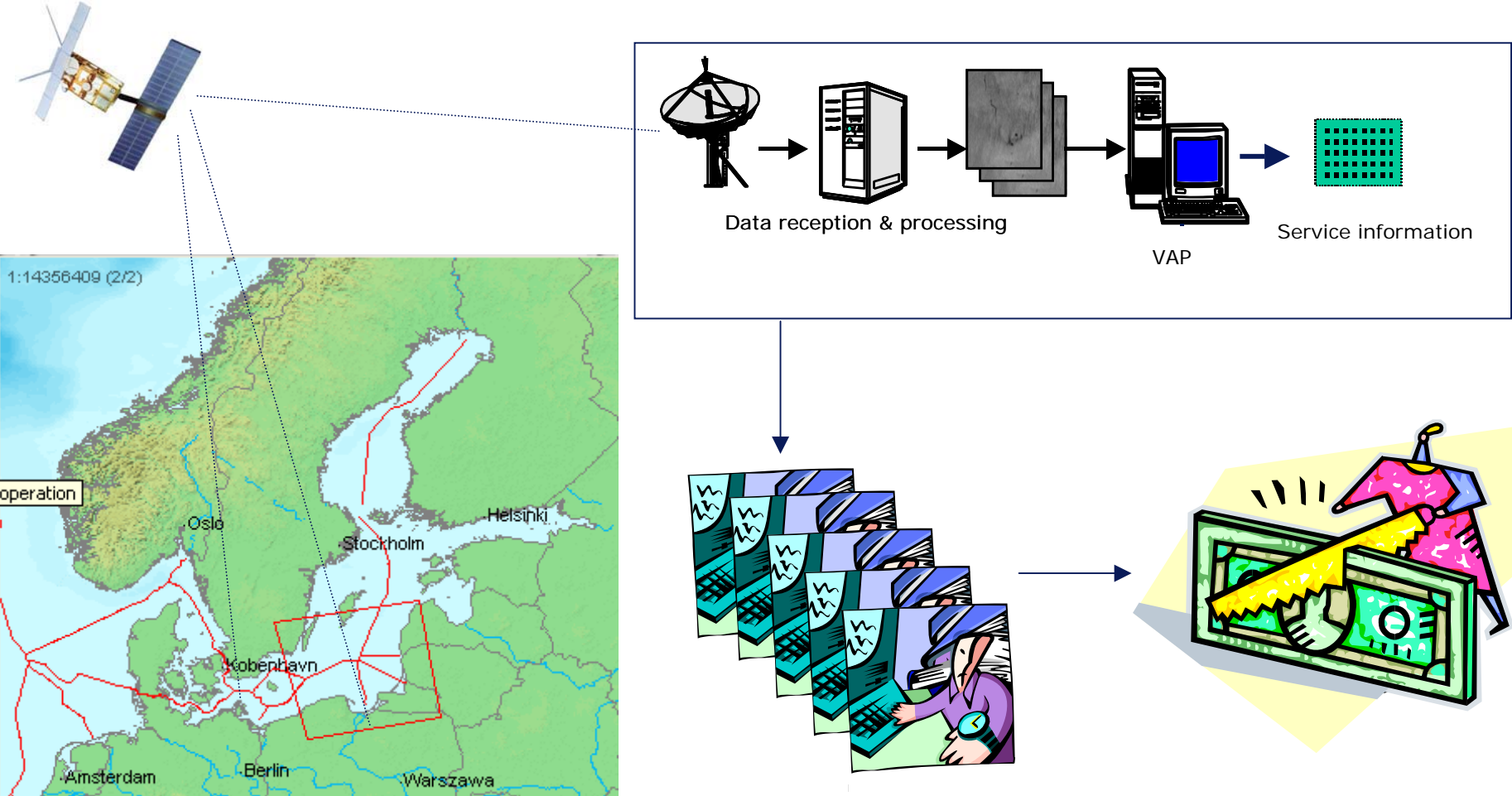


Multinational Service Concept

- Positive feedback from customers
- Improved co-operation among neighbouring states
 - Aerial surveillance resources can be shared and used efficiently
 - Joint flight planning
 - Diplomatic clearance to fly into each others area
- Substantial cost savings
 - Cost sharing between users
 - Exploit common coverage gives increased satellite coverage for each user
 - Affordable for coastal nation with small EZ
 - One common web service
 - Reports are distributed to all service members
- A nation receive urgent phone notification only if a possible oil spill is located within the nation's EZ



Multinational Service Model





Conclusions

- Today the satellite based oil monitoring service is in operational use by the key end-users in Northern Europe
- The multinational concept has been successful and have reduced the bottlenecks for further service development
- With such a concept established throughout Europe service costs and information can be shared among regional, national and international authorities.
- Experiences can be used to develop services in new regions





A next goal – the Global Near Realtime Data Service

- Global data dump for every orbit for all satellites supported
- Provide access to 20-25 missions supported by KSAT
- Access within 2 hours to data from anywhere in the world
- High resolution SAR and optical data
- Rapid distribution channel in cooperation with satellite owner
- Improved access to data for customer



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